Remarks

In addition to entry of the previously filed amendment which was mailed on April 14th, 2004, applicants wish the Examiner to consider the following remarks in reply to the Advisory Action dated April 27th, 2004.

The Examiner indicated that no evidence had been supplied by applicants as to the meaning of load cell, and that nothing was argued that points out the error in the office's determination. Attached herewith are two (2) definitions of load cell that support applicants' assertions. The first definition is taken from the Cornell University website, and the second is from the website of Capgo Pty. Ltd., a company "focusing on measurement, monitoring, and data acquisition." The error in the office's determination is that the so-called "load cell" referred to by the Patent Examiner in Knowles does not employ a transducer to measure forces and torques. Therefore, the device in Knowles is clearly not a load cell.

Applicants respectfully do not understand the statement by the Examiner that "As to the meaning of "monitor" - there is no evidence that the date at the time of the invention. Also, there is no page number, etc."

In addition to the assertions made in the previously submitted response after final, with respect to claim 1, there is no mention or suggestion in Knowles of adjusting the speed of one of the capstans in response to feedback from the load cell.

New claims 59 and 60 have been added which require that the monitoring be done electronically. It is submitted that none of the prior art references, alone or in combination, describe electronic monitoring of the tension at load cell and adjusting in response to feedback from a load cell.

In view of the above amendments and the following remarks, favorable reconsideration of the outstanding office action is respectfully requested.

Claims 1-14, 16-30, 33-37 remain in this application. New claims 59 and 60 have been added. Claims 15, 31, 32, and 38-58 have been canceled.

Based upon the above amendments, remarks, and papers of record, Applicant believes the pending claims of the above-captioned application are in allowable form and patentable over the prior art of record. Applicant respectfully requests reconsideration of the pending claims 1-14, 16-30, 33-37, 59, and 60 and a prompt Notice of Allowance thereon.

Applicant believes that a one (1) month extension of time is necessary to make this Response timely and respectfully requests that the Office grant such time extension pursuant

to 37 C.F.R. § 1.136(a) as necessary to make this Reply timely, and hereby authorizes the Office to charge any necessary fee or surcharge with respect to said time extension to the deposit account of the undersigned firm of attorneys, Deposit Account 03-3325.

Please direct any questions or comments to Robert L. Carlson at 607-974-3502.

Respectfully submitted,

CORNING INCORPORATED

Date: May 14, 2004

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CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.8: I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to Mail Stop: RCE, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on May 14, 2004.

Date of Deposit

Robert L. Carlson
Name of applicant, assignee, or
Registered Representative

Signature

May 14, 2004
Date of Signature

Definitions and Keywords

Angle of twist: For a shaft under torsional loading, the angle through which fixed end of a shaft rotates with respect to the free end is called the angle of twist.

Data acquisition: Data acquisition is a process of digitizing and storing data from any sensor connected to the test system.

Digital controller: The digital controller provides an interface between the computer and the test system. It also contains the feedback loops and aquires data from the transducers.

Elastic material: An elastic material is one which returns to its original shape once the load is removed.

Elastic-plastic torsion: Suppose a shaft is made of ductile material and is subjected to torsional loading. At a particular value of torque known as yield torque, the outer surface yields. As the torque is increased, the outer region of the shaft behaves like a plastic material while the inner core is still linear elastic. This behavior of the shaft can be explained using 'Elastic-plastic torsion' theory.

Feedback: The feedback is a signal from a sensor that indicate the current state of the controlled element, e.g. actuator position.

Grip: Grips hold the specimen in place while testing.

Hooke's law: In a linear elastic body, the stress is directly proportional to the strain. The stresses and strains are related by constants that are solely material property.

Hydraulic Actuator: An actuator is a hydraulically powered device that provides displacement of (or force into) a specimen or structure for testing. The actuators can be linear or rotary.

Hydraulic power supply (HPS): The hydraulic is the mechanical source of high-pressure hydraulic fluid necessary for the test system operation.

Linear actuator: Applies a force or a displacement on the sample to be tested.

Linear elastic material: An elastic material which exhibits a linear relationship between stresses and strains.

Load cell: Load cell is a force transducer used to measure forces and torques.

Load frame: The load frame is the mechanical structure that can react to the force applied to the specimen by the hydraulic actuator. Load frame also provides mounting to other components of the machine.

LVDT (Linear variable differential transformer): LVDT provide an output voltage that is proportional to the displacement of the sample in the test performed.

Maximum torque: It is the maximum torque value reached when a shaft is subjected to torsional loading.

Modulus of rigidity / Shear modulus: The constant relating shear stress and shear strain in a

linear elastic material is called shear modulus or modulus of rigidity. Shear modulus is a material property.

Polar moment of inertia: The moment of inertia of a body about an axis perpendicular to plane of its surface is called polar moment of inertia. Hence, polar moment of inertia is a mass distribution property about an axis perpendicular to its surface.

Rotary actuator: Applies a torque or a rotation on the sample to be tested.

RVDT (Rotary variable differential transformer): RVDT provide an output voltage that is proportional to the rotation of the sample in the test performed.

Servomechanism: A servomechanism is a servo where the mechanical device is a part of the feedback loop.

Servovalve: A servovalve regulates the rate and direction the flow of the hydraulic fluid between the hydraulic power supply and the actuator. This flow determines the magnitude of the applied torque or rotation of the actuator.

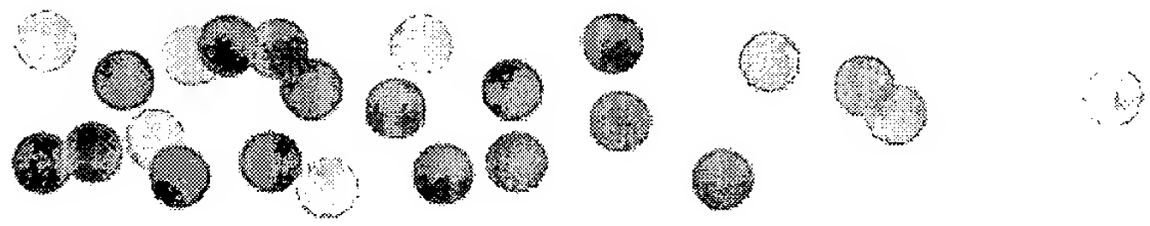
Tibiotarsus: Limb bone formed by fusion of the end of the long bone (tibia) with the ankle bone (astragalus).

Torsion: Torsion refers to the twisting of a structural member loaded by torque, or twisting couples.

Transducer: It is a device that converts a physical quantity (e.g. force, torque, rotation) to an electrical signal.

Ultimate strength: The maximum value of stress that a material can sustain is called the ultimate strength of the material.

Yield torque: The torque value at which the material of a shaft under torsion undergoes first yield is called yield torque. Yield torque only is defined for ductile materials.



Sensor Glossary

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A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A

Absolute Humidity - the mass of water vapor in a unit volume of gas mixture.

Absolute Pressure - the pressure exerted on a vacuum.

Acceleration - the time rate of change of velocity

Adiabatic - a process which takes place without any exchange of heat between a system and its surrounding

Ambient - surrounding or prevailing conditions

Ampere or Amp - the metric unit for electric current

Amp-Hour - a quantity of electricity equal to the integral of the current with time.

Anemoclinometer - a device for measuring the inclination of the wind to a horizontal plane

Anemometer - a device for measuring wind speed

Ängstrom - a unit of length defined as 1/6438.4696 of the wavelength of Cadmium red line, very close to 10^{-10} meter

Aspiration - using a partial vacuum to draw up gas

B

Backlash - similar to hysteresis but more commonly applied to mechanical systems

Barometer - an absolute pressure gauge for measuring atmospheric pressure

Baseline - a reference set of data against which operating data is compared

Bathometer - a device for measuring depth in water

Blackbody - an object that absorbs all incident radiation regardless of spectral or directional composition. A black body will also radiate energy at a rate expressed by the Stefan-Boltzmann Law with a spectral distribution expressed by Planck's radiation equation

Bolometer - an infrared detector that functions by measuring the heating effect of the incident radiation

Bourdon Tube - a pressure sensing element constructed from a flattened tube, seal at one end, twisted or curved. Applied pressure untwists the tube

Bridge - an electronic network that effectively provides zero offsetting. See Wheatstone Bridge

Buckley Gauge - a device that measures very low pressures by sensing the ionization current flow

C

Calibrate - to ascertain the relationship between the input and output of a sensor or measuring device

Calorie - a Unit of heat equal to that required to raise the temperature of 1 gm of water 1°C and is equivalent to 4.184 joules. Some confusion exists when used in the context of food where the kilocalorie is used and termed the "large calorie" but more commonly just "Calorie"

Candela - unit for luminous intensity as related to human eye spectral response

Ceilometer - a device for measuring the height of the base of clouds

Celsius - scale of temperature measurement

Centigrade - obsolete term for Celsius temperature scale

Cerenkov Radiation - visible light produced when charged particles pass through a transparent medium at a speed exceeding the speed of light in that medium

Cold Junction - see Reference Junction and Thermocouples

Color Code - a coding system for identifying a specific type of object within a class of object. See Thermocouple Color Code and Resistor Color Code

Conductivity (electrical) - the property of a water sample to transmit electric current under a set of standard conditions. It is the inverse of resistance and expressed in units of Siemens

Cryogenic - any process carried out at very low temperature - say below -50°C

Cryometer - a low temperature thermometer

Curie Point - the temperature at which a magnetic material losses its magnetic properties

D

Dalton's Law - the total pressure exerted by a mixture of gases equals the sum of the pressures that would be exerted if each of the individual gases present were to occupy the same volume by itself

Dark Current - the current that flows in a photo sensor when there is no incident radiation. Often temperature dependent

Decibel - a logarithmic unit for measuring relative strength of a signal

Dew Point - the temperature at which condensation from the vapor phase occurs

Diffraction Grating - an array of fine, equally spaced reflecting or transmitting lines, which diffracts light in a direction characteristic of the wavelength of the light

Doppler Shift - a phenomenon that causes waves to have a longer wavelength if the source and observer are moving apart and conversely becomes shorter if they are moving together. Very useful effect for flow and speed measurement

Drift - an undesired change in output over a period of time that is unrelated to input. Can be due to aging, temperature effects, sensor contamination etc

Drosomenter - a device for determining the amount of dew that condenses on a given surface

Dry Bulb Temperature - the temperature of the air. Used in conjunction with the wet bulb temperature to measure humidity.

E

Eddy Current - an AC current setup near the surface of a conductor exposed to an electromagnetic field

Electrolevel - a sensor for detecting inclination changes. Consists of a conductive fluid and an air bubble in a seal chamber with three or more electrodes. Used in a bridge circuit with AC excitation. Can be very sensitive although can be prone to drift

EMC - ElectroMagnetic Conformance - standards associated with the emission of undesired radio frequency energy by devices and the level of susceptibility of a device to similar energy

Encoder (sensor) - a device that converts a linear or rotary displacement into digital representation

Erg - unit of energy in the CGS system of units. 1 erg = 10^{-7} joules

Eudiometer - a device for measuring electric current by measuring the volume of gas produced at electrodes during electrolysis

Evaporimeter - and instrument for measuring evaporation rates, particularly of water into the atmosphere

Excitation - power applied to a sensor to enable it to function

Extensometer - a device for measuring small changes in length. Used in geotechnical and materials science areas.

F

Fahrenheit - a temperature scale still in use in USA. See Temperature page

Ferrography - the science of sampling lubricants from machines and analyzing the size distribution of wear particles

Fiber Optic Sensors - a sensor based on some optical property that can be detected by light reflected back through an optical fiber. While expensive, these sensor are safe in hazardous environments

Filter - a circuit or a software program that is able to reduce unwanted noise, thus improving the signal to noise ratio

Fixed Point - or defining point - a reproducible standard value, usually derived from a physical property of a pure substance. For example the triple point of pure water defines a temperature of 0.010°C

Floating - a condition where the voltage on a line relative to a reference point is not defined due to the lack of an electrical connection or due to very high source impedance

Flow Meter - an instrument to measure volume or mass flow of a fluid in a pipe or channel.

G

Gage Pressure - a measure of pressure relative to prevailing atmospheric pressure

Galvanometer - an instrument for measuring small electric currents the movement of a current carrying coil in a magnetic field

Gauss Meter - an instrument for measuring the intensity magnetic fields

Geiger-Muller Counter - a radiation measuring instrument based on a high voltage (200V to 1000V) gas filled tube that detects charged particles using amplification by an avalanche process

Grey Code - a generic term for a family of binary codes that have the characteristic of changing only one bit in the code where incrementing or decrementing a single number in the code. This is done to overcome the potential ambiguity caused by uncertainty about the precise point when individual bits in a non-Grey code flip due to a change of input

Ground - a neutral reference for electrical potential, generally the potential of the Earths crust

H

Hall Effect - a voltage developed as a result of current flow in the presence of a magnetic field. The voltage is at right angles to both the current and the magnetic field. The effect is strongest when the speed of the current carriers is greatest as is some semi-conducting materials

Hertz - the unit of frequency - cycles per second

HPLC - **H**igh **P**ressure **L**iquid **Chromatography** - an sensitive instrument for identifying large molecule compounds

Humidity - an absolute (by mass or volume) or relative measure of the amount of water vapor in air.

HVAC - Heating, Ventilating and Air Conditioning. An acronym used in building and control industries

Hydrometer - a device for indicating the the specific gravity of a fluid

Hygrometer - a device for indicating humidity

Hysteresis - A characteristic of materials, sensors and sometimes instruments to make their behavior dependent on the immediate history to which they have been subjected. Typically the final settling point is different when approached from above to when it is approached from below

I

Impedance - the complex ratio of a force like parameter to a related velocity like parameter. For example temperature to heat flow, voltage to current, pressure to flow

Impulse Excitation - A method of measuring the response of a system by applying a short, sharp pulse

Inclinometer - a device for measuring the change of angle relative to the direction of gravitational pull

Indicator - a device to display the value of a parameter

Infrared - any electromagnetic wave whose wavelength is between 0.78 and 300 µM

Instrument - a device for measuring the value of an observable parameter. The device may display, record or otherwise process the measurement

Integrator - a device that mathematically integrates and input. For example and integrator connected to a flow meter will output the volume pasted since last reset

Intrinsic Safety - A protection method for use in potentially explosive atmospheres that limits the energy available to create a spark or heat surfaces

Ionization Gauge - a pressure sensor based on conduction of electric current through ionized gas Useful below 100 Pa

IP Code - a coding system to describe the level of protection against the penetration by solids and liquids provided by an enclosure or case for equipment. See the IP Codes page

IRGA - InfraRed Gas Analyzer - an instrument able to measure some types of gas in a gas mixture by measuring their characteristic infrared absorption

J K

Johnson Noise - thermally induced electrical noise in resistive elements

Joule - a unit of energy in the MKS units system

Kalman Filter - a process for estimating the value of parameters in the presence of noise and time delays.

Kelvin - an absolute temperature scale. See the Temperature page

Konimeter - a device for measuring dust concentration in air by collecting dust on a glass slide ready for counting under a microscope

L

Leakage - an undesired electric current path from signal wires to ground or other destination. Leakage can introduce significant errors with high impedance sensors

Linearity - The degree of conformity of the output of a system to a straight line match with the measured parameter

Load Cell - a transducer for the measurement of force or weight, usually based on a strain gauge bridge or vibrating wire sensor

Loudness Level - A measure of sound intensity. Expressed in decibels relative to a pressure of 20 µPa at 1 kHz

Lumen - a unit of light flux visible to the human eye

Luminance - the luminous intensity of a surface in a given direction per unit of projected area in a plane perpendicular to that direction

Lux - metric unit of illuminance

M

Magnetometer - an instrument for measuring the strength of a magnetic field

Manpower - in the physical world a unit of power equivalent to 74.60 watts. Obsolete

Mass - the amount of matter in a object, not to be confused with weight which is the result of gravity acting on a mass.

N

Noise - The generally unwanted component of a signal that tends to interfere with the measuring process. The noise can be random or periodic, and often varies in intensity

O

Odometer - a device that displays the distance traveled by a motor vehicle

Ohm - a unit of electrical resistance

Oleometer - a device for measuring the specific gravity of oil as a means of determining purity.

Olfactometer - and instrument for measuring the sense of smell by issuing know concentrations of odorous materials.

P

Pachymeter - an instrument for measuring the thickness of material, particularly paper

Parameter - in the context of sensors, the thing that is being measured

Pedometer - a device for measuring to distance walked

Penetrometer - an instrument for determining the strength of semi-solids such as grease, wax and soil

Peltier Effect - the observable effect of a voltage generated by a temperature

gradient in two wires of dissimilar metals joined at one end. See the Thermocouple page for more details

pH - logarithmic measure of the hydrogen ion concentration in water. It is measured with a pH electrode

Phytometer - a device or system for measuring the transpiration of plants

PID - **P**roportional-**I**ntegral-**D**eriverative - refers to a control method where the controlling signal is a function of the error, the error's history and the error's rate of change

PIN Photo-diode - a semiconductor light detecting diode with a particularly fast response time

Pirani Gauge - a sensor for low pressures (<100 kPa) that utilizes the pressure dependent effect of thermal conductivity between air and a heated wire

Pitot Tube - a sensor to measure fluid velocity by generating a pressure that is the difference between the total static pressure and the dynamic pressure

Piezoelectric Effect - the generation of electric charge by certain materials when a force is applied, or conversely the deformation of the material when a potential is applied. Usually electrodes are deposited or attached to the material to facilitate electrical coupling

Plank's Equation - an equation defining the radiation emitted by a blackbody. See Non-Contact Temperature Sensors

Pyroelectric Effect - the generation of electric charge by certain materials when heat is applied by conduction or radiation

Q

Quantization - the sub-division of the range of a reading into a finite number of steps, not necessary equal, each of which is assigned a value. The concept is particularly applicable to analog to digital and digital to analog conversion processes

Quantum noise - noise due to the discrete or particular nature of light and other short wavelength electromagnetic radiation

Quartz - a transparent crystalline mineral of silica that finds application in sensors due to its optical and piezoelectric characteristics

R

Radiation Shield - in air temperature measurement a vented and reflective enclosure to shield a sensor from incident infrared radiation. See the Temperature page. In the nuclear field a heavy shield to absorb high energy subatomic particles

Raoult's Law - a dissolved substance will lower the partial pressure of the solvent proportionally to the mole fraction of the dissolved substance. Useful phenomena for the calibration of humidity sensors.

Reynolds Number - an important dimensionless number associated with fluid flow and used in scaling fluid systems and in determining the transition point from laminar to turbulent flow. It represents the ratio of the momentum forces to the viscous forces in the fluid flow

RTU - **R**emote **T**ransmitter **U**nit - a device accepts data from a range of sensors and telemeters the information to a distant destination for recording and processing. RTUs can also receive instructions and act on them as part of a control loop

S

Scale factor - a constant multiplier which converts an instrument reading to a measured value in standard units for the parameter being measured

Scanner - a switching device that enable a single measuring instrument to sequentially sample multiple sensors

Self Heating - a generally undesirable characteristic of some types of sensors, particularly temperature sensors, to be heated by the excitation power required to obtain a reading. See the Temperature page

Sensitivity - the smallest change in a physical quantity or parameter that can be detected by a measuring system. Determined by signal to noise ratio, system amplification and / or quantizing limit

Sensor - a device that detects the value or the change of value of a physical quantity or parameter and converts the value into a signal for an indicating or recording instrument. Also see Transducer

SteinHart and Hart equation - a mathematical description of a thermistor's

temperature to resistance relationship. (Also see the Capgo Thermistor Calculator)

Stevenson Screen - a radiation shield used to house outdoor meteorological instruments

Strain Gauge - a device that responds to mechanical strain. Metal foil gauges are the most common type, responding to strain with a small change in resistance. Also vibrating wire types

T

Tachometer - an instrument for measuring the speed of rotation

Telemetry - The process by which measured quantities from a remote site are transmitted to a data collection point for recording and processing

Temperature - a measure of the amount of heat in an object expressed in degrees on one of the established temperature scales

Thermistor - a temperature sensor based on the high temperature coefficient of resistance of certain semi-conducing materials. See the Thermistor page for details

Thermocouple - a temperature sensor based on voltage produced by a temperature gradient in two wires of dissimilar metal joined at one end. See the Thermocouple and Thermocouple Color Code pages for more detail

Thermopile - an array of usually series connected thermocouples designed to increase to signal level and or provide a degree of spatial temperature averaging. See the Thermocouple page

Time Constant - The time required to complete 63.2% of the total rise or decay after a step change of input. It is derived from the exponential response $e^{-t/T}$ where t is time and T is the time constant

Time Series - a sequence of data assigned specific moments in time. It is the history of the object of interest

Torque - a rotary force

Transducer - a device that converts an input signal of one form into an output signal of another form. Often used interchangeably but not necessarily correctly with sensor. In this work, "sensor" generally refers to the "raw" sensing element which is strictly speaking a transducer, and the term "transducer" is used to describe a sensor with some signal conditioning within the package

Turbidity - the optical opacity of water containing suspended matter. Measured with a nephelometer

Tyndall Effect - the side ways scattering of light passing through a transparent fluid containing suspended material

U

Ultrasonics - the technology associated with the use of sound above 15 kHz. Applied to thickness, density, flow and level sensing. Also used for imaging

U-Tube Manometer - a sensitive means of measuring low pressures by use of a partially fluid filled U shaped tube. Suitable for Gage and Differential pressure measurement

V

Vapor Pressure - the pressure (at a given temperature) at which a liquid is in equilibrium with is vapor

Venturi Meter - a flow meter that measures flow rate by determining the pressure drop through a venturi constriction

Vibrating Plate Electrometer - a means for measuring high impedance voltage source using a capacitor with a vibrating electrode to rapidly change the capacitance. The resulting small current flow can then be measured via series resistor

Vibrating Wire Strain Gauge - a device that responds to strain by changing its natural resonant frequency. The wire is electrically plucked and the frequency measured. Alternatively wire can be maintained in continual vibration with appropriated circuits

Viscosity - a measure of internal friction of a fluid. Metric units of viscosity are poise, however there are a number of other units used in industry, particularly for lubricants and sugar.

Volt - a unit of electromotive force or potential difference

Vortex Flow Meter - a sensor that detects the frequency of vortex shedding behind an obstacle in flowing fluid by small pressure variations

W

Warm-up Period - the time it takes a circuit to stabilize after the application of power.

Watt - the metric unit of power

Wet-Bulb Temperature - the lowest temperature a wetted body will attain when exposed to an air current. It is the temperature of adiabatic saturation.

Wheatstone Bridge - a four arm resistance bridge having 1, 2 or 4 variable resistances. It is commonly used with resistance based sensors, especially strain gauges and RTDs. It is effective in suppressing to zero point thus allowing higher amplification and for temperature compensation

Wien Bridge - a type of AC bridge, now rarely deployed

Wind Chill Factor - a factor applied to temperature that attempts to better represent the feel of low temperature, wind and humidity on people

Wollaston Wire - a fine platinum wire used in hot wire anemometers. It is made by drawing a silver sheathed platinum wire and dissolving the silver with acid. Is being replaced with micro-machining methods

X Y Z

Zero Suppression - a process used to increase system sensitivity of sensors with a large output offset. By suppressing the zero, higher amplification may be applied. The bridge circuit is an example